A Clinical Study of Some Antiseptics in the Treatment of Otorrhœa

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IN considering the treatment of inflammations of the middle ear by means of antiseptic agents, it is desirable to call to mind the distinction between the prophylactic and the curative uses of antiseptic applications. We employ prophylactic antisepsis in order to prevent the entrance of micro-organisms into wounds, while by means of curative antisepsis we endeavor to render aseptic wounded or diseased areas in which micro-organisms have already secured lodgement.

The anatomical structure of the ear renders comparatively narrow the field of application of antiseptics for prophylactic purposes. In operations and wounds involving the tragus, helix, and the periosteum of the mastoid process, antisepsis can be employed with prophylactic effect. Indeed, in operations in the external auditory canal we may hope for the same effect, although here, for manifest reasons, it is more difficult to secure and retain a perfectly aseptic condition. If there be perforation of the drum-membrane, the possibility of keeping the organ completely free of germs is practically out of the question, for the connection between the tympanic cavity and the throat—namely, through the Eustachian tubes—is always a way open for the bacteria which pass into the mouth with every inhalation and with every mouthful of food.

From the anatomical structure of the ear, then, comparatively little is to be expected from the employment of

[1] Read before the Clinical Society of Baltimore, February 1, 1889.

antisepsis as a prophylactic. As a curative agent it does admirable work.

There are two ways by which an antiseptic fluid may reach the middle ear. First, by way of the external auditory canal through a perforation of the drum-membrane; and second, through the Eustachian tube. Through this latter channel the fluid can reach the middle ear, but owing to the small opening and the difficulty of its access the operation becomes tedious and frequently impracticable. And furthermore, there is necessarily a good deal of the liquid swallowed by the patient. Now, some of our most valuable antiseptics, when taken internally, even in small doses, produce toxic symptoms. The external ear, then, is the safest and simplest road to the middle ear.

It is not surprising, in cases of obstinate suppurative inflammations of the middle ear, that these affections do not yield promptly to treatment, for the different parts of this division of the ear are singularly difficult of access. The middle ear is simply a series of channels, spaces which are divided and subdivided into a large number of smaller spaces. The drum-cavity, the centre, with its irregular and angular walls, is the point from which ramify the divisions of the middle ear. Here are numerous pockets where a discharge can rest and become a nidus for organisms. On the posterior wall there is the opening into the antrum mastoideum, or horizontal portion of the mastoid process, another point where secretions can accumulate. From thence we pass on into the mastoid process itself, where are located the mastoid cells. Here we have an array of pockets, chambers, recesses in which micro-organisms can secure lodgement. It is thus evident how difficult, nay, almost impossible, it is to obtain an antiseptic condition of the middle ear.

After these preliminary considerations concerning the general uses of antiseptics, and the difficulties inherent in the anatomical structure of the ear regarding their application, I will now mention the antiseptics which I have employed during the past fifteen months in treating suppurative processes of the ear.

Carbolic acid gave most indifferent results. A disadvantage peculiar to carbolic acid is its tendency, says Kretschmann,[1] in a one per cent. solution, to produce eczema and otitis externa, accompanied with great pain. I cannot say that my experience entirely confirms this statement, but what I have seen of its action in otorrhœa has convinced me that it is, comparatively speaking, an inferior agent. Koch's investigations show that the spores of the anthrax bacillus, when exposed to a one per cent. solution of carbolic acid, are not destroyed. Only after exposure for twenty-four hours to a five per cent. solution is their activity destroyed. The pus micro-organisms, however, are much less resistant than the spores of anthrax bacilli, so that we cannot reject the use of carbolic acid in the treatment of most cases of suppurative otorrhœa simply on the ground of its inferior antiseptic powers; but its irritating properties, as cited by Kretschmann, form a positive objection to its employment. Moreover, it has not yielded in my hands so satisfactory curative results as some other agents.

As regards iodoform, though I have used it in several cases, I must confess I have not given it an extended trial. Very few patients in private practice will tolerate its presence, particularly in the ear, where, from the exposed position of the organ, it is more difficult to suppress the odor. This objection I have found a not infrequent one, even among the better class of dispensary patients. In those cases where I used it the patients were undoubtedly benefited, for the discharge was clearly lessened by daily applications of the powder. The question as to the antiseptic value of iodoform is such a vexed one, and laboratory experiments and clinical experience differ here so widely, that I will not attempt a discussion of the subject from this point of view. It is claimed that iodoform owes most, if not all, of its antiseptic value to its property of destroying ptomaines. For an interesting survey of the present

[1] Archiv für Ohrenheilkunde, Bd. xxvi., S. 109.

status of the iodoform question, I would refer to a recent article in the *Annals of Surgery*[1] by William W. Van Arsdale, M.D.

In 1880 Bezold advised the use of finely pulverized boracic acid for acute and chronic suppurating diseases of the drum-cavity with perforation. This agent is recommended mainly for its value as an antiseptic. It is supposed to act not only by disinfecting the secretion, but also by preserving an aseptic condition of the mucous membrane. Again, it is urged that its freedom from irritating qualities permits its use with perfect impunity by laity and physician alike. And, finally, the persevering use of boracic acid is claimed, with few exceptions, to cure every discharge from the ear. Such promises naturally provoked an unqualified use of this agent, but it was not long before reports appeared which showed that boracic acid fell far short of doing in every case what was expected of it; that there were limitations to its use, certain kinds of cases where it was indicated, others where it did absolutely no good, others again where it was positively dangerous.

Professor Schwartze, of Halle, in his treatise, "Die Chirurgischen Krankheiten des Ohres," says that in certain cases of chronic otorrhœa, boracic acid, when introduced in small quantities into the ear, will effect a cure. Such cases are those in which the perforation is large and situated in the lower quadrant of the drum-membrane, and in which the secretion is not very abundant. He advises against the use of boracic acid when the secretion is very abundant and thick, for here a sticky mass will be formed which adheres to the walls of the cavity and stops up and prevents the egress of the discharge, and which sometimes results in retention of pus, inflammation of the mucous membrane covering the bones, and, finally, of the bones themselves. Schwartze thinks that the use of boracic acid is contra-indicated in acute otorrhœa of the drum-cavity.

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[1] Vol. ix., No. 3, pp. 201–216.

Here we have a thick muco-purulent discharge, and generally a very small perforation, and just such a condition may arise as described above, namely, retention and all its unfortunate consequences.

Dr. Stacke,[1] in an article on the subject, mentions a case of chronic otorrhœa with medium-sized perforation, situated on the upper portion of the drum-membrane. Inasmuch as the mucous membrane seemed pale and smooth and the discharge was slight, only a small quantity of powder was blown into the ear. After four weeks, during which period he had not seen the patient, the latter came back for an examination. There had been no discharge for some time. The drum-membrane was coated with a fine adherent scale, and, on using the Politzer bag, a moist râle was heard. A closer examination revealed a drum-cavity full of pus. In this case there existed a condition unfavorable for the free exit of the discharge, the slight secretion in the beginning had formed over the perforation a thin scale which, with time, became stronger and more resistant, and when the secretion increased in quantity, the scale which covered the perforation was too strong to give way, and hence retention followed. Timely discovery prevented dangerous consequences. In two cases he observed brain-symptoms after three weeks' use of the powder. Stacke mentions four other cases of chronic otorrhœa, which he had treated for a long time with boracic acid. In all four cases the discharge was brought to a standstill, but suppuration continued, and before he obtained complete recovery he was obliged in two cases to trephine the mastoid, and in the other two, excise the malleus.

Dr. Grüning,[2] of New York, reports three cases of death from retention of pus after a long use of boracic

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[1] Die Behandlung der Otorrhoe mit Borsäurepulver, Deutsche Med. Wochenschr., No. 49, S. 1062, 1887.

[2] Three Fatal Cases of Middle-ear Suppuration after Treatment with Boric-acid Powder. Transactions of the American Otological Society Vol. iv., Part i., 1887.

acid in the powder form. In the course of the disease nothing unusual was observed in either case, till after they had been for some time under the boracic-acid treatment. Two cases died of meningitis, and the other one of pyæmia. In one of the cases the mastoid process was opened the day before death, and it was found full of pus.

I have not met with such unfortunate results in my experience with boracic acid, although entire paralysis of one side of the face occurred in a child that had been seen by me not long ago, and which condition might readily be attributed to having packed the external ear with the powder. The case was that of a child aged eight years, that had been troubled with a persistent otorrhœa for three years. An examination showed that the entire drum-membrane was gone, and that the tympanic cavity was full of granulations. I touched the latter with chromic acid and prescribed an acid sublimate solution, to be poured into the ear three times daily, and to remain in the ear five or ten minutes at a time. I heard nothing more of the patient for a month, when I received a letter from the family physician stating that the child was paralyzed on the left side of the face. For the first three or four days after using the sublimate solution the discharge, from having been copious, had lessened to a few drops a day, and the fetor had entirely disappeared. The doctor said that, not being able to stop the discharge completely, he thought he would pack the ear with powdered boracic acid. This was done, and ten days later he noticed the facial palsy. Facial paralysis as a result of otitis media is not a very rare occurrence, and it is quite possible that, even had the boracic acid not been used, the paralysis would have shown itself sooner or later. In this case, however, the disease for three years had been marked by no unusual symptoms, and for two weeks was so improved by a certain line of treatment that the otorrhœa had nearly ceased, and the accompanying odor had entirely disappeared. A new treatment was then adopted, and a

few days later the case presented a more unfavorable outlook than at any time during the three years. It is quite fair to conclude that the powder offered a mechanical obstruction to the small discharge that was still going on, and that this latter, accumulating in the bottom of the cavity, produced pressure upon the chorda tympani and hence paralysis, or, possibly, an actual extension of the inflammation to the nerve itself ensued. This is the only instance in my experience when the use of boric acid was attended with unfortunate consequences. Both in the powder form and in solution this agent has done me good service, and many persistent otorrhœas have been permanently cured.

I have found no agent, however, which has yielded such good results as the bichloride of mercury. I use it in solutions varying in strength from 1 to 3,000 to 1 to 8,000 and 10,000.

Koch's investigations show that the spores of the anthrax bacillus are rendered perfectly innocuous after a few minutes' immersion in a 1 to 20,000 sublimate solution. In experiments made with a sublimate solution of 1 to 1,000 the following organisms were destroyed in eight seconds: Anthrax bacilli (free from spores); the bacilli of diphtheria, glanders, and typhoid fever; streptococci from puerperal fever and from pus, the staphylococcus aureus and albus and the organism of erysipelas. A solution of such strength is, of course, much too strong for the ear. The strongest solution that I have ever used is 1 to 3,000, and even this has caused pain when poured into the ear. The strength of the solution that I generally use is 1 to 5,000, and with this I have never had any complaints from the patients. It is well known that when a sublimate solution comes in contact with a substance containing albumen that a precipitate is thrown down which is usually regarded as the albuminate of mercury. This reaction is supposed to take place when we pour such a solution into an ear from which there is a purulent discharge, and here I would allude to the contradictory

experiments of Drs. Laplace [1] and Behring.[2] The first of these investigators proved that when the albuminate of mercury is precipitated that the sublimate solution has lost much of its germicidal property. The same investigator has shown that this precipitate may be prevented by making the sublimate solution slightly acid. This solution, Dr. Laplace says, has lost none of its antiseptic value by the addition of the acid; on the contrary, it is a more powerful germicide than ever. Either tartaric or muriatic acid was used. According to Dr. Behring, this albuminate of mercury does not exist, or, rather, does not in the slightest degree resemble the insoluble albuminous coagulum produced by acids or heat. The so-called albuminate of mercury redissolves easily in acids, in iodide of potash, cyanide of mercury; in short, in all bodies which have the property of redissolving precipitates of mercury obtained in an aqueous solution. Furthermore, one can obtain from the serum of blood containing sublimate, dissolved by means of tartaric acid, the same reactions as those which an aqueous solution of sublimate will give. Again, all the reagents capable of dissolving the chloride of silver, as ammonia and cyanide of potash, are equally capable of preventing chloride of silver from producing a precipitate in blood-serum, and are capable of dissolving such a precipitate when it does occur, all of which goes to prove that the salts which are present in the blood play an important part in the existence of metallic precipitates, and that the albumen found in the precipitate is, so to speak, carried along mechanically. Dr. Behring further finds that the acid sublimate solution is a quarter less active as a germicide than the non-acidulated sublimate solution.

So much, then, for the question as viewed from the light of laboratory experiments. Clinical experience is not yet

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[1] Säure Sublimatlösung als desinficirendes Mittel und ihre Verwendung in Verbandstoffen, Deutsche Med. Wochenschr., No. 40, S. 866, 1887.

[2] Ueber Quecksilbersublimat in eiweisshaltigen Flüssigkeiten, Centralblatt für Bakteriologie u. Parasitenkunde, 2. Jahrgang, Bd. iii., Hft. 1, 2.

so divided, and I am every day, as surgeon in charge of a large ear clinic, together with frequent confirmations from my colleagues, being convinced of the positive good effected by the acid sublimate solution.

The following is the prescription used:

℞ Hydrarg. bichlor. ..... gr. ss
Acid. tartar. ..... grs. xx.
Aquæ ..... q. s. ad ℥v.

The patient is first required to syringe the ear out with warm water, and then to pour the sublimate solution into the ear till the latter is quite full. The fluid is allowed to run out after remaining in the ear ten or fifteen minutes. A piece of cotton is then moistened with the solution, and with it the external opening of the ear is closed. This treatment is repeated two or three times a day. As far as possible, then, the tissues of the drum cavity, its remote connections, and the whole external auditory canal are kept in a condition unfavorable for the growth of organisms. A marked diminution in the discharge is seen almost immediately, and not infrequently a patient will remark upon the absence of odor after the first day's applications. In granulations and in polypi sublimate solutions have only the effect of removing the fetor, the discharge is not lessened to any extent. Such conditions demand special treatment. But in the ordinary otorrhœa resulting from otitis media, which affection forms so large a percentage of the dispensary patients, the acid sublimate solution has given me most satisfying results. About seventy-five cases have been collected by me during the past year; but, unfortunately, I have not been able to follow up more than forty to the point of complete recovery.

As regards relapses, since I began treating the majority of suppurating diseases of the ear with an acid sublimate solution, I think I can safely say that the good done here has been no less permanent than when the majority of cases were treated with boracic acid or other agents. I

may say that the greater part of the time a similar case was always kept on the boric acid treatment, to judge of its relative merits, and in by far the majority of cases the improvement was quicker when the sublimate solution was used. Certainly the fetor disappeared more promptly when the latter agent was employed. The following cases may be regarded as fairly typical of the efficacy of this mode of treatment:

Case I.—C. K——, thirteen years of age. Chronic otitis media. Medium sized perforation. Otorrhœa for two years. Treated with insufflations of boric acid for two weeks with no visible improvement. Commenced to use the sublimate solution, and the discharge had stopped on the eighth day. The perforation had become smaller, and subsequently healed over entirely.

Case II.—F. O——, thirty-three years of age. Chronic otitis media. Otorrhœa twelve years. Drum membrane nearly gone. No sign of discharge on the tenth day. The patient was seen for three or four days after this, and as the otorrhœa had not returned he was discharged, with the injunction to come back if he had any further trouble. It is now at least six months since he was last seen.

Case III.—P. K——, eight years of age. Otitis media. Otorrhœa six weeks. Small perforation in upper and anterior quadrant of drum membrane. The ear stopped discharging after using the sublimate solution for four days. As usual, the patient was kept under observation for several days after the discharge had ceased, at the end of which time he was allowed to go, and he has not been seen since.

Case IV.—J. B——, five years of age. Acute suppuration of the middle ear. Small perforation and otorrhœa for one week. There was no sign of the discharge on the tenth day.

Case V.—Mrs. R——, fifty years of age. Chronic inflammation of the middle ear. Large perforation and otorrhœa for four months. The discharge stopped on the seventh day. There was no closing up of the perforation

though the ear remained free of any discharge, and the patient was allowed to go after having been about two weeks under observation.

Case VI.—A. W——, two months old. Otorrhœa first noticed about ten days after birth, and, furthermore, in both ears. In eight days the discharge from both ears had ceased.

Unfailing success was claimed by the author of the boric-acid treatment, but the experience of many aural surgeons has not borne out the truth of this promise. Certainly no such claim can be made for the sublimate solution. To succeed always is the lot of no drug. Some cases get well with no other treatment than syringing out the ear with warm water several times daily. This, however, is the exception. It will be observed that four days was the quickest period of time in which the discharge was stopped by the sublimate solution. I once stopped the discharge from an ear with two insufflations of boric acid. But this, again, is a very rare exception, and proves nothing as to the relative superiority of boric acid to other agents. It is impossible to explain how an agent which will put a stop to an otorrhœa in two days, and that, too, with a single daily application, will, in a dozen other cases which present to examination almost the same objective features, demand many days to do any good, and frequently fail to cure completely.

Bacteriological researches in cases of suppurative inflammation of the middle ear have been recently made by Zaufal,[1] Moos,[2] Rohrer,[3] and Netter.[4] According to these investigators, four distinct species of pathogenic micro-organisms are concerned in the production of suppurative inflammations of the middle ear, sometimes one and sometimes more than one variety being found in the same case.

[1] Prag. Med. Wochenschrift, 1887, No. 27; 1888, No. 8.

[2] Zur bacteriellen Diagnostik u. Prognostik der Mittelohreiterungen. Deutsche Med. Wochenschr., November 1, 1888.

[3] Ueber die Pathogenität der Bakterien bei eitrigen Processen des Ohres. Ibid.

[4] Annales des Maladies de l'Oreille. October, 1888.

These organisms are the micrococcus Pasteuri, discovered by Sternberg in his own saliva, and recognized by him as the cause of sputum septicæmia in rabbits—and subsequently by Fraenkel, Weichselbaum, and others as the cause of croupous pneumonia in human beings (diplococcus pneumoniæ); the bacillus pneumoniæ of Friedländer, the staphylococcus pyogenes, and streptococcus pyogenes. In fetid otorrhœa bacilli and cocci are always found; in non-fetid cases only cocci (Zaufal). The streptococcus are found most often associated with serious complications, as, for instance, subcutaneous abscesses, mastoiditis, meningitis, purulent infection. That we possess in bichloride of mercury the most perfect of germicides has been amply proven, and upon theoretical grounds, then, did Kretschmann, a little over a year ago, suggest that a sublimate solution be employed in suppuration of the middle ear. From experience I can testify to the value of the suggestion, and from an antiseptic point of view the question hardly admits of argument.

To sum up: 1. Carbolic acid, to get its full antiseptic value, must be employed in a solution too strong to be used in the ear without doing positive harm. 2. Iodoform will not be tolerated by the majority of patients, and did not give me as good results as boric acid. 3. Inasmuch as the recent experience of aural surgeons has shown that the use of boric acid in the powder form is associated with danger,[1] I comparatively seldom use the agent in this form. In the saturated solution boric acid is a valuable agent. 4. If the ear be thoroughly cleansed with warm water, and the acid sublimate solution be allowed to remain in for ten minutes or more, and the ear then closed with a pledget of cotton which has been moistened with the solution, the clinical observations of the past few months have led me to conclude that this solution has a somewhat larger field of usefulness, and will show a somewhat larger percentage of cures than the other three agents.

[1] Antisepsis in der Ohrenheilkunde, Archiv f. Ohrenheilkunde, Bd. xxvi., S. 113.